REMARKS

In the last Office Action, claims 1-4, 7, 8, 10, 13-17 and 21 were rejected under 35 U.S.C. §103 as being unpatentable over Miyazawa or the admitted prior art (APA) in view of Sumihara. Claims 5, 6, 18-20 and 22 were rejected under 35 U.S.C. §103 as being unpatentable over Miyazawa or APA in view of Sumihara and further in view of Sawayama. Claim 12 was allowed.

In accordance with this amendment, independent claims 1, 13 and 22 have been amended to define with more particularity the novel construction of the inventive ultrasonic motor to better patentably distinguish over the prior art. Claims 1 and 13 have been amended to add that the ultrasonic motor includes a supporting plate, such as the supporting plate 1 shown in Fig. 2, that supports the oscillating member 6, the moving body 5 and the pressing mechanism 7, and to further define that the current path that would be established between the conductive member and an electrode of the piezoelectric member would be established through the support plate or the moving body of the ultrasonic motor. Claim 22 has been amended in minor formal respects to recite that the moving body is "in contact with" (rather than "disposed contacting") the oscillating member and to recite that the insulating material (of which at least one of the

oscillating member, pressing mechanism and moving body is formed) "forms an insulator" to provide antecedence for the later recitation of "an additional insulator." Claims 1, 13 and 22 have also been amended to exclude the presence of an "additional insulator".

These minor claim amendments do not raise any new issue that would require further search or consideration. The addition of the "supporting plate" to claims 1 and 13 helps define the current path that would be established, which would be established through either the supporting plate or the moving body, and the changes made to claim 22 are formal in nature. The exclusion of an "additional insulator" was extensively argued in the previous response and supplemental response and therefore does not raise a new issue. Moreover, in view of the extensive prosecution of this application, including a decision on appeal, applicants respectfully request this opportunity to place the claims in condition for allowance or in better form for appeal. Accordingly, favorable consideration and entry of this amendment are respectfully solicited.

The present invention pertains to an apparatus having a power supply for supplying power to an electrical device and an ultrasonic motor for driving an output member, the ultrasonic motor having a piezoelectric element driven by a driving circuit to undergo vibration to drive an oscillating member in contact with the piezoelectric element, and the piezoelectric element and the driving circuit forming a self-oscillation circuit.

As described at pages 1-2 of the specification, a wide variety of electronic devices are commonly equipped with an ultrasonic motor for use as a source of motive power. An illustration of a known analog clock having such a construction is shown in Fig. 11 of the application drawings. An oscillating body 3 having a piezoelectric device 4 bonded thereto generates an oscillatory wave by self-excited oscillation to drive a moving body 5. A conductive base plate 21 is directly connected to the positive terminal of a power supply for driving the clock and serves as a lead wire for carrying a positive potential to the clock movement. When an ultrasonic motor is mounted to the conductive base plate 21, electrodes of the piezoelectric device 4 may short-circuit with the positive power supply terminal through the conductive base plate 21 and stable driving becomes impossible. As a result, in order to mount a self-oscillation circuit (self-oscillating drive circuit) for an ultrasonic motor, it is necessary to form the base plate of an insulating material or to provide a separate insulator between the base plate and the ultrasonic motor.

This is due to the fact that various components of the ultrasonic motor, including the oscillating member, the moving body, the output member, and a pressing mechanism, are typically formed of conductive materials. When a voltage is

applied to the conductive base plate 21, a current path can easily be established between at least one of the electrodes of the piezoelectric element and at least one of the power supply terminals. This makes stable driving of the motor impossible. Since various components of the ultrasonic motor are formed of conductive materials, it becomes necessary to eliminate the current path between the power supply and the piezoelectric device by forming components of the electronic device contacting the ultrasonic motor of a non-conductive insulating material. However, this imposes design restrictions on the electronic device structure in which the ultrasonic motor is mounted. In a small electronic device, it is difficult to provide an insulating structure due to space restrictions and, if an insulating structure is mounted therein, it may be difficult or impossible to also mount an ultrasonic motor.

The present invention solves this problem in a simple yet effective manner and does so without imposing size or structural restrictions on the electronic device. In accordance with the invention, an ultrasonic motor is driven by a self-oscillation circuit, which is advantageous due to its small size and excellent frequency follow-up characteristics, and one or more components of the ultrasonic motor are made of insulating material or have insulating

surfaces to prevent a current path from being established between the conductive plate member (which is connected to the power supply) and electrodes of the piezoelectric element of the ultrasonic motor. More particularly, one or more of the oscillating member, moving body and pressing mechanism of the ultrasonic motor are formed of an insulating material or formed with an insulating surface so that no additional insulating structure is needed to prevent a current path from existing between the conductive base plate and the piezoelectric element electrodes. As a consequence, it is possible to realize an ultrasonic motor that does not impose structural restrictions on the electronic device in which it is mounted.

Independent claims 1 and 13, as amended, recite an apparatus having a power supply for supplying power to an electrical device and a movable member driven by an ultrasonic motor, wherein the ultrasonic motor is mounted to a conductive member (base plate) through which a power supply current is passed from the power supply to the electrical device. Claims 1 and 13 further recite that the ultrasonic motor comprises a piezoelectric element, a driving circuit cooperating with the piezoelectric element to form a self-oscillation circuit for driving the piezoelectric element, an oscillating member in contact with the piezoelectric element to undergo oscillation

in response to vibration of the piezoelectric element, a moving body disposed on the oscillating member to undergo movement in response to oscillation of the oscillating member, a pressing mechanism for urging the moving body against the oscillating member and a supporting plate that supports the oscillating member, the moving body and the pressing mechanism. Claims 1 and 13 further recite that the ultrasonic motor is constructed such that if the oscillating member, the pressing mechanism and the moving body were formed of conductive materials, a current path would be established between the conductive member on which the ultrasonic motor is mounted and an electrode of the piezoelectric element through the supporting plate or the moving body of the ultrasonic motor, and that at least one of the oscillating member, the pressing mechanism and the moving body is formed of an insulating material having a volume resistivity sufficient to prevent establishment of the current path and attain stable self-oscillation without the need for additional insulator between the conductive member and the ultrasonic motor. Claims 1 and 13 additionally require that no additional insulator is provided between the conductive member and the ultrasonic motor. No similar apparatus is disclosed or suggested by the prior art references.

The primary reference to Miyazawa discloses in Fig. 44 an ultrasonic motor which, as noted by the Examiner, comprises an oscillating member 2-27, a conductive support member 4-27, a piezoelectric element 3-27, a moving body 1-27 and a pressing mechanism 9-27. The piezoelectric element 3-27 has on its underside electrodes 3a-27 which are electrically connected through an anisotropic conductor 46 to a circuit pattern 47a on an insulating substrate 47 disposed on the conductive support member 4-27. The anisotropic conductor 46 is comprised of rod-shaped conductors 46a separated by insulators 46b, and the rod-shaped conductors 46b provide a current path between the piezoelectric element electrodes 3a-27 and the circuit pattern 47a on the substrate 47. This exemplifies the prior art constructions in which a separate insulating structure in the form of the insulating substrate 47 is required rather than, as in the case of the present invention, forming one or more of the oscillating member, moving body or pressing mechanism of an insulating material or with an insulating surface so that no additional insulator is needed to prevent a current path existing between the conductive support member and the electrode(s) of the piezoelectric element. More importantly, Miyazawa does not disclose forming at least one of the oscillating member 2-27, moving body 1-27 and pressing mechanism 9-27 of insulating material or with an insulating surface as required by independent claims 1 and 13.

As acknowledged by the Examiner in the August 2, 2005 Office Action (page 3, lines 3-4), both Miyazawa and APA (shown in Fig. 11 and described in the present specification) require additional insulation between the ultrasonic motor and the conductive member on which the ultrasonic motor is mounted. Neither Miyazawa nor APA teach or suggest that the insulation between the conductive member and the ultrasonic motor could be eliminated without short-circuiting the electrodes of the piezoelectric device through the conductive member, which would result in unstable self-oscillation or complete stoppage of the ultrasonic motor. Thus insofar as pertinent to independent claims 1 and 13, both Miyazawa and APA teach that insulation between the ultrasonic motor and the conductive member on which the motor is mounted is required in order to obtain stable self-oscillation. Claims 1 and 13 expressly require that there not be an additional insulator between the conductive member and the ultrasonic motor.

In the statement of rejection, the Examiner states that it would have been obvious to one of ordinary skill in the art to modify Miyazawa or APA to construct the moving bodies thereof of fiber-reinforced resin as taught by Sumihara to obtain the benefits of lighter weight, ease of manufacture, etc. described by Sumihara. Applicants respectfully point out, however, that even if such a modification were made, both

Miyazawa and APA would still retain the "additional" insulation between the ultrasonic motor and the conductive member on which the motor is mounted. Stated otherwise, even if Miyazawa and APA were modified in the manner proposed in the statement of rejection, the modified devices would still have additional insulation between the ultrasonic motor and the conductive member and hence would not meet the terms of claims 1 and 13 which expressly exclude such additional insulation.

Sumihara does not contain any teaching, suggestion or motivation for eliminating an insulator between an ultrasonic motor and a conductive member on which the motor is mounted by forming the moving body of a fiber-reinforced resin. Therefore Sumihara would not have taught or suggested to one skilled in the art to eliminate the insulators employed in Miyazawa and APA. Instead, Sumihara simply teaches the benefits of forming the moving body of a fiber-reinforced resin, and such benefits would still exist if the moving bodies of Miyazawa and APA were formed of fiber-reinforced; however, the Miyazawa and APA devices would still have an insulator between the conductive member and the ultrasonic motor.

Moreover, claims 1 and 13 require that at least one of the oscillating member, the pressing mechanism and the moving body be formed of an insulating material having a volume resistivity sufficient to prevent establishment of the current path and attain stable self-oscillation without the need for an additional insulator between the conductive member and the ultrasonic motor. It is not seen where the various composites disclose by Sumihara have sufficient volume resistivity to prevent establishment of a current path and attain stable self-oscillation if the insulator between the conductive member and the ultrasonic motor were eliminated in the Miyazawa and PAD devices. If the moving bodies of Miyazawa and PAD were formed of carbon fiber reinforced resin, such resin material would affect self-oscillation of the self-oscillation circuit and stable self-oscillation would not be attained.

Independent claim 22, as amended, is directed to an electronic apparatus having a power supply for supplying power to an electrical device, a conductive member through which a power supply current is passed from the power supply to the electrical device, and an ultrasonic motor having a part mounted on and electrically connected to the conductive member. The ultrasonic motor further includes a piezoelectric element, a driving circuit cooperating with the piezoelectric

element to form a self-oscillation circuit for vibrating the piezoelectric element, an oscillating member in contact with the piezoelectric element to undergo oscillation in response to vibration of the piezoelectric element, a moving body in contact with the oscillating member to undergo movement in response to oscillation of the oscillating member, and a pressing mechanism for urging the moving body against the oscillating member, wherein at least one of the oscillating member, the pressing mechanism and the moving body is formed of insulating material that forms an insulator to prevent establishment of a current path between the conductive member and one or more electrodes of the piezoelectric element without the need of an additional insulator between the conductive member and the ultrasonic motor, and wherein no additional insulator is disposed between the conductive member and the ultrasonic motor.

As pointed out above, if Miyazawa or APA were modified so that the moving bodies thereof were formed of fiber-reinforced resin as taught by Sumihara, the modified devices would still retain an additional insulator between the ultrasonic motor and the conductive member on which the motor is mounted. Sumihara does not contain any teaching or suggestion of eliminating the insulator between an ultrasonic motor and a conductive member on which the motor is mounted

and, therefore, Sumihara would not have taught or suggested to one skilled in the art to eliminate the insulators in the Miyazawa and APA devices even if the moving bodies thereof were formed of fiber-reinforced resin.

By contrast, claim 22 requires an electronic apparatus having an ultrasonic motor mounted on and electrically connected to a conductive member through which a power supply current is passed from a power supply to an electrical device, wherein at least one of the oscillating member, pressing mechanism and moving body of the ultrasonic motor is formed of insulating material that forms an insulator to prevent establishment of a current path between the conductive member and one or more electrodes of the piezoelectric element of the ultrasonic motor without the need of additional insulator between the conductive member and the ultrasonic motor, and wherein no additional insulator is disposed between the conductive member and the ultrasonic motor. The modified Miyazawa and APA devices would have an additional insulator between the conductive member and the ultrasonic motor and hence would not meet the terms of claim 22.

In view of the foregoing, it can be seen that independent claims 1, 13 and 22 clearly patentably distinguish over the combined teachings of the prior art. Accordingly, favorable reconsideration and entry of this amendment together with allowance of the claims are respectfully requested.

Respectfully submitted,

ADAMS & WILKS
Attorneys for Applicants

By: _____
Bruce L. Adams
Reg. No. 25,386

17 Battery Place
Suite 1231
New York, NY 10004
(212) 809-3700

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DONNA RICCARDULLI
Name

Donna Riccardulli
Signature

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